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Retrieval of ammonia from ground-based FTIR measurements and its use for validation of satellite observations by IASI

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Atmospheric Ammonia (NH3) has a major impact on human health and ecosystem services and plays a major role in the formation of aerosols [Erisman et al.,2013; Paulot and Jacob 2014]. NH3 concentrations are highly variable in space and time with overall short lifetime due to deposition and aerosol formation. The global atmospheric budget of nitrogen and in turn NH3 is still uncertain which asks for more ground-based and satellite observations around the world. Recent papers have described the possibility to measure NH3 with satellite infrared sounders which open up the way for calculations of global and regional nitrogen budgets [Clarisse et al 2009,Van Damme et al 2014a]. Validation of the satellite observations is essential to determine the uncertainty in the signal and its potential use. So far available surface layer observations of atmospheric NH3 concentrations have been used for comparisons with total columns retrieved from satellite observations [Van Damme 2014b]. We developed a retrieval for NH3 column density concentrations (molecules NH3/cm2) by fitting a set of spectral windows to ground-based solar absorption Fourier transform infrared (FTIR) measurements with the spectral fitting program SFIT4 [Hase et al., 2004]. The retrieval is then applied to FTIR measurements from a set of spectrometer sites from the Network for detection of Atmospheric Composition Change (NDACC) to retrieve NH3 columns for the sites located in Bremen, Germany; Lauder, New Zealand; Jungfraujoch, Switzerland; and the island of Reunion, France. Using eight years (2005-2013) of retrieved NH3 columns clear seasonal cycles are observed for each of the stations. Maximum concentrations can be related to NH3 emission sources, specific for the regions. A comparison between the retrieved NH3 columns and observations from the recent IASI- NH3 product [Van Damme et al, 2014a] using strict spatial and temporal criteria for the selection of observations showed a good correlation (R=0.82; slope=0.63). The IASI- NH3 columns for the Bremen and Lauder area show similar temporal cycles when compared to the FTIR observations.